JUVENILE AND IMAGINAL LUMINESCENCE IN FIRE-FLIES (LAMPYRIDÆ)

By Charles T. Brues
Biological Laboratories, Harvard University

In spite of the extensive literature relating to luminous lampyrids very slight attention has been paid to those forms in which the light-producing organs of the adult beetle are greatly reduced in size and brilliance.

On June 15th the writer collected at Petersham, in central Massachusetts, a number of pupæ which were provided with luminous organs near the tip of the abdomen. In general appearance and in the size, form and position of these organs they resembled the pupæ of one of our common native fireflies, *Photuris pennsylvanica*, which appears abundantly every year at this locality later in the month of June. The pupæ were at the bottom of a pile of old boards that had been thrown into an open field some years ago and were rapidly undergoing final decay and dissolution. Altogether, 54 pupæ were secured and put by in the laboratory to follow the expected development of the imaginal light organs.

Some of these pupæ began to transform into beetles during the following night and their emergence continued for a period of a week. To our surprise, however, the eclosed adults were not Photuris, but another common lampyrid, *Lucidota atra* Fab. represented by individuals of both sexes.

It has been generally observed that the small larval pair of photogenic organs persist in the pupæ and may pass over into the adult, *e.g.*, in *Photinus consanguineus* where the male retains the larval organs in addition to his much larger and separate imaginal one which is developed as a purely adult structure.

Lucidota belongs to a small group of related genera in which the imaginal photogenic organs are feeble and consist entirely of the remains of the precursory juvenile structures. To this group belongs also Pyropyga, a species of which (*P. fenestralis* Mels.) has been observed by Hess [1] to possess larval light organs which continue to function throughout the pupal period. He

[1] Biol. Bull., vol. 38, pp. 39–76 (1920).

noted that as the time for emergence of the beetle approaches the glow usually becomes very faint although rarely persisting for a brief period after emergence. Degeneration extends still further in another related genus Ellychnia, and in our common *E. corrusca* no adult luminescence is to be noted, at least in completely matured individuals. The larval organs persist in a degenerating condition in adult beetles as was shown by Williams.[2] Some recent workers do not recognize these several genera as distinct, grouping them all together as Lucidota which is the oldest name.

The question as to whether the adult photogenic organ in these species should be regarded as vestigial or whether it represents a stage preceding the development of the large and brilliant organ of Photinus is of considerable interest. Inasmuch as luminescence in these beetles has been generally thought to be a sexual manifestation which facilitates mating, we should be inclined to consider the reduced condition in Lucidota as vestigial. On the other hand, the fact that the large adult organ in the male of Photinus is without question a structure developed later and in addition to the persisting larval organs which pass over into the adult without loss of function, we must conclude that the pair of larval organs are phylogenetically older and that the imaginal organ is a more recent acquisition. What purpose the larval organs may serve is not clear. It has been suggested that they may enable the larvæ to recognize one another and it is known that these creatures are gregarious, although not to a high degree. We can hardly admit on this basis that luminous spots can play any real part in the ecology of the larval beetles. Aside from the complex morphology of the brilliant imaginal organs, the integument covering them is greatly modified by the complete loss of pigment. In Lucidota there is no indication of any such change as the ventral abdominal segments are fully blackened in conformity with the general very dark body color of the beetles, and the visibility of the persistent larval organs is effected only through the weakly pigmented, extrusible tip of the abdomen.

It is unfortunate that we do not know more concerning these less spectacular fireflies and the place that they occupy in the evolution of this most varied and remarkable group of luminous beetles.

[2] Journ. Morphol., vol. 28, pp. 145–207 (1916).